

THE OPERATIVE TREATMENT OF FACIAL NEURALGIA—A COMPARISON OF METHODS AND RESULTS.

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NEURALGIA as it affects the trigeminal or fifth cranial nerve is, perhaps, with the exception of sciatica, the most common form of the disease. The branches most commonly affected are those of the ophthalmic and superior maxillary or first and second divisions of the nerve. Either of these separately, and frequently both at the same time, may be affected. The third division is the part most rarely attacked by the more intractable form of the disease, and still more rarely does it occur that this latter is attacked in conjunction with one of the other nerve trunks.

When the situations of these nerves are taken into consideration, and the fact that they pass through foramina and canals with bony, and hence unyielding, walls, together with their distribution to the teeth, organs especially prone to destructive processes among civilized nations, and the exposure of their peripheral extremities to alternations of heat and cold, it is not a matter of surprise that they are frequently the seat of neuralgia. In addition to these, neuralgia here as elsewhere, may depend upon the condition which Erb has called "the neuropathic predisposition."

It is my purpose to deal only with those obstinate, agonizing and otherwise intractable cases which fall under the surgeon's care for operative treatment, in this paper. It may not be out of place to consider briefly the character and origin of these severe forms of the disease, and with that end in view it will be convenient to speak of them as being of peripheral and

of central origin. Examples of the former may be instanced as due to neuritis, acute and chronic, idiopathic or traumatic; morbid growths upon the bony walls of foramina through which the nerve or its branches pass; syphilitic periostitis in these localities, and neuromata. Cases of undoubted peripheral origin also occur in which none of these conditions can be demonstrated as being present. These form the subject of surgical interference most frequently, although it is not at all uncommon to have operative measures invoked in cases of central origin. The latter class of cases, although they form a very important group, are of minor importance in the present inquiry, depending as they do upon diseases of the central nervous system and associated with such conditions as sclerosis, cerebral softening, tumors, hyperæmia, etc., for which operative measures, although they may serve for a time in holding in check the peripheral pain, cannot in the true sense of the word be said to be curative. Nor can any more than a like effect be claimed for the interposition of surgical art in the class of cases in which injury to a remote nerve, for instance the ulnar, as in a case cited by Anstie, is the cause of persistent pain in the branches of the trifacial. Those neuralgias of a reflex character, or irritations of peripheral organs transferred in the central nervous system to sensory paths, in which latter they give rise to the sensation of pain, although scarcely to be classed among true neuralgias, also deserve mention in this connection, from their intractable and chronic character.

To return to the class of cases in which the sensations of pain, referred to the periphery, are due to diseased conditions of the central nervous system—even here a well-planned operation will frequently give the most brilliant results, although of an evanescent character. This is attested by the published experiences of Schuh¹, Nussbaum², A. Wagner³, Patruban³ and S. D. Gross. The beneficial results, however, which in most cases can be expected to be but temporary, are not easily explained. Bell⁵, many years ago, made the observation that

¹ Ueber Gesichtsneuralg. u. Nervenresection, 1858.

² Bayer. *Aertzl. Intelligöl.*, 1863.

³ Ueber nervös Gesichtschm., etc. *Langenbeck's Archiv.*, xi.

⁴ Woch. d. Geseltsch. a. Wien. *Aertz.*, 1869.

⁵ London, 1830.

section of the nerve produced an alterative and tonic effect upon the nervous system. A. Wagner¹, on the other hand suggested that the improvement depends upon the fact that the excitation of the central lesions by the centripetally conducted stimuli are productive of the paroxysms of severe pain; by interrupting these for a time, the diseased central organ is at once placed in the condition of rest, and this, the first essential in the cure, becomes at once accomplished. The practical point involved in this attempt to account for the beneficial results is obvious, and has an important bearing upon the necessity, or otherwise, of an extensive operation. If the first mentioned theory, so well expressed in the words of Erb², "that the strong peripheric stimulus of the operation is the cause—though in what way it acts is not very obvious—of the disappearance of the neuralgia, and that, like strong counter-stimulation of the skin, it acts as an energetic stimulant, and thus leads to at least temporary recovery," is the correct one, it will be at once evident that an extensive operation upon the nerve trunk is not indicated; on the other hand, upon the theory of giving complete rest to the diseased central organ by removing the route or medium of communication along which peripheral stimuli are conveyed, a more radical operation would be indicated.

Having thus, as briefly as possible, considered the class of cases of facial neuralgia coming under the care of the surgeon, it is proposed to consider, from a practical standpoint, what resources we possess for the relief of these sufferers, excluding the use of hypodermic injections, both those which act through the medium of the general circulation, such as morphine, atropine, etc., as well as those which have a purely local action, such as osmic acid, for the reason that these measures of relief have, as a rule been faithfully tried before the case comes to the surgeon. There remain those measures more distinctively surgical upon which surgeons have relied with greater or less confidence in the operative treatment of this affection. These include neurotomy, neurectomy, nerve stretching and the arrest of arterial blood supply.

¹ Op. cit.

² Diseases of Peripheral Cerebro-Spinal Nerves. V. Ziemssen's Cyclopædia, vol. xi, p. 95.

NEUROTOMY.—Naturally the first operation of anything like a radical character to which surgeons resorted in the treatment of these cases, was that of neurotomy. The attempt to inhibit the propagation of the irritation arising from some pathological change in the nerve by dividing the medium of communication between the seat of change and the brain was hailed as a panacea in the class of cases under study. That it was resorted to, in the first instance in a most unscientific manner, the early literature of the subject clearly shows. Instances are frequently mentioned, in which motor, as well as sensory nerves were divided, and the frequent occurrence of paralysis of the muscles of the face, led surgeons to regard these cutting operations with distrust. Later on we find, after physiologists had definitely pointed out the functions of the nerve distribution of the face, the operation was revived, only to be again rejected, when a more extended experience with it as applied to nerves of a purely sensory function demonstrated its almost utter inutility as a permanently curative measure. It was soon discovered that cases almost invariably relapsed after neurotomy, and the reason for this became at once evident. The divided portions of the nerve became reunited, and as soon thereafter as its essential elements were restored, the pain returned. At the present time the operation, if performed at all should be resorted to only in those cases of central origin as a step preliminary to excision of a portion of the nerve, and may, perhaps be supplanted by that of nerve-stretching, to which attention will be called further on. The operation finds but few, if any supporters at the present day, and is quite ignored in the more recently written treatises upon surgery.

NEURECTOMY.—Nerve excision, or neurectomy, suggested no doubt by the frequent occurrence of reunion of the divided nerves, after simple neurotomy, and the consequent ultimate restoration of its functions and return of the pain, rapidly gained in favor by its incomparably better results. This was achieved mainly through the efforts of A. Wagner, of Germany, and Dr. Carnochan and the late Prof. James R. Wood, of New York. Marechal, surgeon to Louis XIV performed it for the relief of trigeminal neuralgia as early as the fifteenth

century¹. Wagner² has laid the profession under the greatest obligations by the systematic collection and tabulation of cases of neurectomy for the relief of intractable neuralgia of the fifth cranial nerve. Prof. Dennis³, of New York, has collected and tabulated a number of cases of neurectomy of the second division of the trifacial in which the sphenopalatine or Meckel's ganglion was also removed, this constituting the procedure commonly known as Carnochan's operation. The names of Schuh⁴, von Nussbaum, Billroth and Patruban are also prominently identified with the surgery of the trigeminal nerve.

Owing to the difficulty of determining, in most instances, the exact seat of the change in the nerve in cases of peripheral origin, it will be manifestly proper, in this class of cases, at least, to excise a portion of the nerve as close to its point of exit from the brain as possible. This has led to the devising of most extensive dissections, as in the operation of Carnochan, and osteoplastic resection of the superior maxilla as adapted by von Nussbaum⁵ and Gerster⁶ of New York, after Langenbeck's operation for the removal of naso-pharyngeal growths. Some of the most daring undertakings in surgery have been entered upon for the relief of this class of sufferers. That patients are found who are willing, and even anxious, to submit to these extensive mutilations only serves to show how dire must be their extremity, how pressing their need for relief. It is likewise of importance in centrifugal cases, if a neurectomy has been decided upon, that as much of the nerve, in a peripheral direction, as possible, should be removed; in other words, the entire trunk, together with as many of its branches as practicable, should share in the excision. The reason for this is obvious: should the source of irritation be situated at a point bordering upon the area of distribution of a neighboring nerve, or at a peripherally distant point, it is quite possible that a communicating filament or twig passing to the latter may

¹Hildenbrant. *Nervendehnung. Neurektomie und Nervennaht*; Ein Beitrag zur Nerven Chirurgie. Berlin, 1884.

²Wagner. *Archiv. f. Chirurgie*, Band XI.

³N. Y. Med. Journal, June, 1879.

⁴Am. Journal Med. Sciences. Phila. Vol. 35, page 134. 1858.

⁵Aertzliches Intelligenz Blatt, August, 15, 1863.

⁶Med. Record, N. Y. 1882, Vol. XVI, p. 300

exist, in which case the irritation would be conveyed along this route to the brain. That these communications frequently exist between nerve trunks and their branches, and that a nerve is capable of transmitting to the brain impressions of sensations having their origin in a neighboring and communicating nerve, there can be no doubt, although it may be conceded that no true anastomosis, in the sense that the nerve tubules with their myeline become continuous, one with another, as in blood vessels, takes place. The researches of Waller demonstrate the fact that each nerve tubule, with its axis cylinder and myeline are continuous from origin to termination. But when a communicating branch is given off, it implants itself upon, or becomes attached to the neighboring nerve in such a manner as to recurve or direct its course, so to speak, towards the central origin. In the plexuses these branches are known to be given off, and in the ultimate distribution of nerves more or less communication exists where different areas of distribution border upon each other. These facts, namely, the existence of communicating branches, both in the plexuses and peripheral distribution, and the direction of their course after becoming attached, from the periphery toward the centre, coupled with the now general belief that the sensory nerves convey impressions only from the periphery to the centre, while motor nerves convey the current of nerve force from centre to periphery, will serve to explain why these communicating or anastomosing branches or twigs make their influence felt, in the cases of sensory nerves, and yet are of no avail in motor paralysis. For these reasons it is advisable to follow, whenever possible, the nerve, from the point where its trunk breaks up into the branches distributed to the surface, as far as possible in the direction of this distribution. This may be done by turning up a flap, as in Carnochan's operation, and by following up the nerve trunk in a central direction to the point where it emerges from the base of the skull. In those cases in which the particular branch involved can be definitely determined, the suggestion of Agnew¹ may be followed of planning the operation in accordance with the relative degree of local pain. Diffi-

¹Principles and Practice of Surgery, Vol. 1, 316.

culty, however, will almost always be encountered in settling this point, and most surgeons will prefer to excise the entire nerve trunk as well as its branches, whenever practicable.

In cases of undoubted central origin it becomes a serious question regarding the operation to be performed; the wisest course, it would seem, to pursue, would be to employ a limited neurectomy, conjoined with nerve-stretching at the outset, in the hope that the influence of this counter-stimulant will have a favorable effect upon the disease. This can be repeated as often as the pain recurs, providing the intervals of freedom are reasonably long, and warrant the belief that these correspond with the length of time usually occupied by the processes of degeneration and regeneration of the divided nerve. This could not be expected to occur under six months, at the shortest, according to Augustus Waller¹. Should the pain return within a shorter space of time than that above mentioned, it would probably be due, not to an immediate union of the divided ends, and restoration of function without degeneration occurring, for this is denied by most authorities; but probably to the existence of a communicating branch from a neighboring nerve between the point of section and the central lesion. In such an event a subsequent complete neurectomy would be indicated.

In obstinate cases of peripheral origin there can be no question as to the propriety of operating by neurectomy. The accessibility of a portion of the nerve to the surgeon's knife, lying between the seat of pathological change and the brain, constitutes a positive indication for operative interference.

It sometimes occurs that, after a time, the sensation returns in the area of distribution of the excised nerve trunk, without a return of the neuralgia. This disappearance of anæsthesia, without relapse, in cases of peripheral origin, is believed to be due to the fact that the diseased condition of the nerve disappears during the degenerative and regenerative processes which nerves undergo after the infliction of traumatism sufficient to produce temporary abolition of their function. The

¹A succinct résumé of the results of the experiments of Waller, adapted from Ranvier, is given in an able paper by Prof. Markoe, entitled "Secondary Nerve Suture," *ANNALS OF SURGERY*, vol. 2, p. 189.

longer this return of sensation is delayed, the better the prognosis as regards duration of relief or permanent cure.

It has been suggested by Erb that a recurrence of the pathological condition, for which the nerve was excised, may occur in the central segment, and thus lead to a relapse. It might also be pointed out that the presence of a neuroma upon the stump of the resected nerve, as occurs sometimes after amputation, would produce, to a greater or lesser degree, the former symptoms.

In cases of supposed central origin after resection of the nerve to the point where it makes its exit from the skull, the pain will sometimes be found to persist with considerable intensity and be referred by the patient to the area of distribution of a neighboring branch or division of the trifacial. This, after a time, in its turn disappears, and a cure results. Here, probably, the central lesion involved the common origin of the three divisions beyond the Casserian ganglion, and which, upon the theory of Bell, already mentioned, became favorably influenced by the neurectomy, leading to a gradual disappearance of the pain. This was the termination in the case of S. herewith reported (Case No. 80).

In cases of peripheral origin, after neurectomy the pain will sometimes persist for a few days and then gradually disappear. This is explained by the fact that the morbid condition also involved some communicating or anastomosing twigs. As the process of degeneration goes on in these, after resection, the symptoms abate and finally cease altogether.

The question as to the permanency of the favorable results brought about by the operation of neurectomy has been frequently discussed, and the voices of equally great and eminent authorities have been raised both for and against it. Doubtless enthusiastic operators have been led to claim more for the operation than its merits deserved; on the other hand, an unfortunate experience, too small, perhaps, upon which to found an estimate of its real value, has probably often led to its unjustifiable condemnation. Like the two knights of old, one is apt to look upon his own side of the shield only, and as one happens to approach the question from the standpoint of a fortunate issue to a trial of its merits upon the one hand, or an untoward result upon the other, so are we likely to foster in

our minds either an exalted opinion of its value, or an impression of its utter inutility. Many of the older surgeons, Dieffenbach among them, considered the performance of a neurectomy as but a last desperate attempt on the part of the surgeon to relieve the victim of his terrible affliction.

Hildenbrandt¹ quotes O. Weber as having based an estimate of the value of the operation upon a study of 100 cases. Of that number, eighteen are stated to have been cured. The length of time during which these cases remained under observation is not stated.

The summary of Wagner's cases is of far greater value in this connection. This author, in his collection of 135 cases, places the number known to have been cured after a lapse of three years as eighteen. Against this apparently small number of cures he has six fatal cases to offset whatever advantage might be supposed to have accrued from the operation. Upon examining further, however, into Wagner's cases, the following facts appear: In only a single case did the relief last less than a month. In thirty-two cases the relief could be estimated in months, and for periods varying from one to three years twenty cases were free from pain. Of those cases which suffered relapse, this latter was known to have persisted up to a year following the operation in eighteen cases, and between one and three years in twenty-five cases. Besides this there were twenty-four cases known to have been completely relieved from pain, but in which, owing to the fact that the patients were lost sight of, the duration of the improvement could not be definitely stated. In the six fatal cases, occurring as they did in the pre-antiseptic period of surgery, all were due to the so-called infectious wound diseases; hence, in these days of comparative freedom from wound sequelæ, they need scarcely be taken into account.

In order to further the objects of this paper, and present whatever claims neurectomy may be thought to have upon us, as a palliative or curative measure, I have collected from various sources eighty-three cases of neurectomy; most of these having been performed since the appearance of Wagner's classical article upon this subject. These I have tabulated for purposes of study as follows:

¹Op. cit.

TABULATED STATEMENT OF CASES OF NEURECTOMY FOR RELIEF OF FACIAL NEURALGIA.

<i>No. of Case.</i>	<i>Operator.</i>	<i>Sex and Age.</i>	<i>Duration of Disease.</i>	<i>Date of Operation.</i>	<i>What Nerve.</i>	<i>Meckel's ganglion removed. If so, how?</i>	<i>Duration of Relief.</i>	<i>Length of Nerve Removed.</i>	<i>Remarks.</i>	<i>Reference.</i>
1	Carnochan.	M. 69.	5 years.	Oct. 16, 1856.	Sup. Maxillary.	Yes.	No return of pain in 14 months.	Excision to a point beyond Meckel's ganglion.		Amer. Jour. Med. Sciences. 1858. Vol. 35, p. 134.
2	Carnochan.	M. 54.	29 years.	Oct. 10, 1857.	Sup. Maxillary.	Drawn out after section, hanging to trunk.	No return of pain in 7 weeks.	2 inches.	Pain continuous for 9 years prior to operation. Division of infra-orbital nerve had been performed 3 times previously without success.	do. p. 139.
3	Carnochan.	F. 55.	6 years.	Nov. 5, 1857.	Sup. Maxillary.	Yes.	Reported at end of 1 mo.; no return at that time.	2 inches.	Subcutaneous neurectomy of branches of infra-orbital had previously given only partial relief.	do.
4	Nussbaum.	F. 38.	10 years.	Feb. 1, 1858.	Supra- and infra-orbital, inf. alveolar and mental.		5 months.	1 inch.	Relief for 5 months; then pain returned and relieved by loosening cicatrix at lower edge of orbit. Three months after pain in infra-maxillary region, trephined ascending ramus of in-	Aertliches Intelligenz Blatt. Aug. 15, 1863.

5	do.	M. Age 3 years. not stat- ed.	March, 1859.	Supra and in- fra orbital.			2 years and 5 months.	1 inch.	Relief until May, 1862. Cicat- trices cut out. Complete relief to date.	fra-maxillary and removed 4 to 5 inches of infr. alveolar, mylo- hyoid and lingual nerves. Re- lief for 9 months; neurectomy of infra- and supra-orbitals, re- moving 1 inch. In January, 1860, cicatrices removed for re- lief of pain, which had returned; 10 months relief, then great pain in whole left side of face. Patient three months advanced in pregnancy but, yielding to her entreaties, Nussbaum per- forated the antrum of Highmore and incised the nerve far back. Hæmorrhage alarming; tampon and styptics relieved this, but recurrence of bleeding neces- sitated ligature of carotid. (See case No. 1. Abstract of carotid ligations).
6	do.	F. 50. Several years.	Feb. 6, 1860.	Supra and in- fra-orbital, superficial, and deep temporal.			2 years.	Not stated.	On Oct. 8, 1862, supra and infra-do. orbital cicatrices cut out. Re- lief to date.	

TABULATED STATEMENT OF CASES OF NEURECTOMY FOR RELIEF OF FACIAL NEURALGIA. *Continued.*

<i>No. of Case.</i>	<i>Operator.</i>	<i>Sex and Age.</i>	<i>Duration of Disease.</i>	<i>Date of Operation.</i>	<i>What Nerve.</i>	<i>Meckel's ganglion removed. If so, how?</i>	<i>Duration of Relief.</i>	<i>Length of Nerve Removed.</i>	<i>Remarks.</i>	<i>Reference.</i>
7	Nussbaum.	M. 60.	10 years.	July, 1860.	Supra- and infra-orbital.		1 year.	Not stated.	August 13, 1861, cicatrices removed. Relief 1 year. Same operation repeated Oct. 27, 1862. Relief to date.	do.
8	do.	M. 68.	22 years.	Sept., 1860.	Supra- and infra-orbital.			Not stated.	Relief partial. Trephined as in do. Case No. 4. Complete recovery and relief.	do.
9	do.	F. 60.	Several years.	Sept. 28, 1860.	Supra- and infra-orbital.			1/2 in.	Relief but slight. Dec. 7, 1862, tied common carotid, loosened cicatrices; resected superficial and deep temporals, etc. "Pains more endurable."	do.
10	do.	F. 38.	7 or 8 years.	Oct. 9, 1860.	Supra- and infra-orbital.				Oct. 30, 1860, trephining and resection as in Case No. 4. Relief for 2 1/2 years. May 26, 1863, cicatrices loosened and infra-orbital canal opened, as in Case No. 4. Cicatrix in infra-maxillary trephined and removed. Relief.	do.

11 do.	M. 58.	30 years.	Nov. 1, 1860.	Supra-and infra-orbital.			Not stated.	Relief in that region to date. do. Some pain in infra-maxillary region, but not enough to demand operation.
12 do.	F. 60.	Several years.	Nov. 14, 1860.	Supra-and infra-orbital.		1 year and 9 months.	Not stated.	Relief to date. do.
13 do.	F. 38.	9 years.	1860.	Supra-and infra-orbital.	Yes.		Not stated.	Following Langbeck's method of exposing the sphenoid-maxillary fossa by osteo-plastic resection of the upper jaw, Nussbaum having failed to give relief by ligating the common carotid, removed the entire nerve trunk of the superior maxillary or second division of the fifth, including Meckel's ganglion, in May, 1863. Recovery and complete relief.
14 do.	F. 22.	Several months.	June, 12, 1861.	Supra-orbital				No relief Aug. 20, 1861. Neurotomy of infra-orbital, relief incomplete. Feb. 28, 1862, trephined and resected as in Case No. 4, also removing cicatrices of old operation. No relief March 9.
15 do.	F. 38.	Since youth.	Oct. 5, 1861.	Infra-orbital and lingual				Complete relief, slight facial paralysis. do.

TABULATED STATEMENT OF CASES OF NEURECTOMY FOR RELIEF OF FACIAL NEURALGIA. *Continued.*

<i>No. of Case.</i>	<i>Operator.</i>	<i>Sex and Age.</i>	<i>Duration of Disease.</i>	<i>Date of Operation.</i>	<i>What Nerve.</i>	<i>Meckel's ganglion removed. If so, how?</i>	<i>Duration of Relief.</i>	<i>Length of Nerve Removed.</i>	<i>Remarks.</i>	<i>Reference.</i>
16	Nussbaum.	M. 56.	Many years.	Mch. 6, 1862.					Relief nearly complete.	do.
17	do.	M. 46.	Several years.	July 22, 1862.	Supra-orbital and infra-orbital, trephining, etc. as in Case No. 4.				Complete relief to date.	do.
18	do.	M. 40.	Long time.	Oct. 22, 1862.	Infra-orbital.				Pain returned in 8 months. Common carotid subsequently tied. See Case No. 3, carotid ligations.	do.
19	do.	F. 24.	3 years.	Nov. 17, 1862.	Supra- and infra-orbital.	"6-8 lines."			Free from pain ever since, except in gums of toothless left jaw and in left temporal region.	
20	do.	M. 48.	Almost 5 years.	Jan. 28, 1863.	Infra-orbital.				Recovery complicated by erysipelas. Relief to date.	do.

21	J. R. Wood.	M. 42.	Several years.	April 2, 1866.	Superior maxillary.	Broken up.	No return in 2 years.	Trunk exit for. rotund and leash of branches	Patient lost sight of after 2 years.	N. Y. Medical Journal. June, 1879.
22	Blackman.	F. 35.	14 years.	Jan. 24, 1868.	Sup. max. div. trunk from beyond Meckel's ganglion.	Yes.	20 months	Entire nerve trunk.	Infra-orbital and infra-dental removed, but in Aug., 1869, the paroxysms were as severe as ever.	Amer. Journal Med. Sciences, July, 1869, and Oct., 1870.
23	Cadja, Wm.	F. 38.	Not stated.	April, 1868.	Supra-orbital			Not stated.	Cured (?). Pain remains in temple, corresponding to superior temporal branches.	British. Med. Jour. 1882, vol. ii, p. 83.
24	Aepi.	M. 68.	14 years.	March, 1870.	Infra-orbital.		2 years and 2 4 months.	4 cm.		Zeitschrift f. Chirurgie. Leipsig. 1878.
25	Morton, T. G.	M. 60.	Not stated.	May 24, 1870.	Infra-orbital.			1 inch.	Improved.	Surg. Penna. Hosp. 1880.
26	Wood, J. R.	M. Age not stated.	5 years.	June 29, 1870.	Sup. maxillary division.	Yes.	5-7 months.	Trunk from for. rotund.	Pain returned in inf. dental nerve. A part of this was removed with relief for a time.	N. Y. Med. Jour. June, 1879.
27	Morton, T. G.	F. 51.	30 years.	June 17, 1871.	Infra-orbital.			Portion of trunk.	Cured.	Surg. Penna. Hosp. 1889.

TABULATED STATEMENT OF CASES OF NEURECTOMY FOR RELIEF OF FACIAL NEURALGIA. *Continued.*

No. of Case.	Operator.	Sex and Age.	Duration of Disease.	Date of Operation.	What Nerve.	Merkel's ganglion removed. If so, how?	Duration of Relief.	Length of Nerve Removed.	Remarks.	Reference.
28	Aeppli	M. 70.	2 years.	Jan., 1872.	Infra-orbital.		2 months.	Not stated.		Zeitschrift f. Chirurgie. Leipzig, 1878.
29	Dumont.	F. 59.	2 years.	Sept. 24, 1872.	Infra-orbital.		1 year.	3 cm.		Deutsche Zeitschrift für Chirurg. 1883.
30	Emmet.	F. 57.	2 years.	Sept. 24, 1872.	Infra-orbital.		1 year.	3 cm.	Subcutaneous section of infra-orbital had been done, with temporary relief.	
31	Thorndike.	M. 61.	31 years.	Jan. 3, 1873.	Sup. maxillary division.	Yes. With nerve trunk.		Trunk from foramen rotundum.	For eight years previous to operation the pain had been almost constant. Discharged at the end of 1 month cured.	Boston City Hospital Reports, 2d series, 1877.
32	Dumont.	M. 47.	20 years.	June 14, 1873.	Infra-orbital.		8 months.	3 cm.	Pain returned in 8 months, but not so severe as before operation.	Deutsche Zeitschr. f. Chirurgie. 1883.

33	Wood, J. R.	M. 50.	10 years.	Oct. 6, 1873.	Sup. maxillary division.	Yes.	2 years.	Entire trunk from point of section.	Previously to this operation section of the infra-orbital at infra-orbital foramen had been done, without success. Patient lost sight of.	N. Y. Med. Jour. June, 1879.
34	Cheever.	F. 65.	18 years.	Oct. 11, 1873.	Sup. maxillary division.	Yes.	2 years.	Entire trunk from point of section.	Portion of gum alveolus and superior maxillary had been removed, with relief for three months; at first pain was quite gone, then returned in other cheek, temple and lower jaw as badly as ever. Infra-orbital region free from pain.	Boston City Hosp. Reports. 2d series. 1877
35	Emmet.	F. 60.		Oct. 15, 1873.	Infra-orbital.		1 year and 2 months.	Trunk and $1\frac{1}{2}$ cm. beyond.	Nerve trunk scraped out of canal and removed from $1\frac{1}{2}$ cm. beyond.	Deutsche Zeitschr. f. Chirurgie. 1883.
36	Emmet.	F. 61.		Feb. 13, 1874.	Infra-orbital.		1 year.	Trunk.	do.	do.
37	Dumont.	M. 48.	2 mos.	April 30, 1874	Sup. maxillary.	Yes, burned.	9 years.	Trunk from foramen rotundum.	The stump of nerve near foramen rotundum left after section was cauterized with actual cautery.	do.
38	Letievant.	M. 51.	5 years.	Mch. 18, 1875.	Infra-orbital.		8 days.	8 mm.	Patient left hospital. Operation done for epileptiform variety of disease. Complete relief. Patient lost sight of.	Jacquot "Der Resection, Nervenses," page 15.

TABULATED STATEMENT OF CASES OF NEURECTOMY FOR RELIEF OF FACIAL NEURALGIA. *Continued.*

<i>No. of Case.</i>	<i>Operator.</i>	<i>Sex and Age.</i>	<i>Duration of Disease.</i>	<i>Date of Operation.</i>	<i>What Nerve.</i>	<i>Meckel's ganglion removed. If so, how?</i>	<i>Duration of Relief.</i>	<i>Length of Nerve Removed.</i>	<i>Remarks.</i>	<i>Reference.</i>
39	Orc.	F. 51.	9 years.	July 23, 1875.	Infra and nasal infra-orbital.		8 months.		The patient had been operated on by Lande in 1872, who cut the supra- and infra-orbital nerves at their exit. Relief short. Infra-orbital was then resected in the canal.	Lyon Medical. Aug. 29, 1875.
40	Morton.	M. 42.		Aug. 20, 1875.	Supra-orbital			"Portion of trunk."	"Cured."	Surgery of Penna. Hospital. 1880.
41	Terrillon.	F. 38.	18 mos.	Aug. 1, 1876.	Inf. dental.		4 months.		Relief complete, sensation only partially returned.	Gazette Med. de Paris. 1877.
42	Fowler, G. R.	M. 53.	18 mos.	Feb. 17, 1877.	Sup. maxillary division.	Yes.	1 year.	Entire trunk from foramen rotundum.	Cured. During rest of his life was free from pain. About a year afterward died of cirrhosis of kidneys. An examination of the base of the skull at the post-mortem revealed an entire absence of any traces of an	Proceedings Med. Society, County of Kings. 1877, p. 176

																				attempt at reproduction of nerve tissue. A neuroma the size of a pea was found within the cranium, springing from the superior max. nerve, at the point where it leaves the Casserian ganglion, and just previous to its entrance into the foramen rotundum.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
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TABULATED STATEMENT OF CASES OF NEURECTOMY FOR R OF FACIAL NEURALGIA. *Continued.*

<i>No. of Case.</i>	<i>Operator.</i>	<i>Sex and Age.</i>	<i>Duration of Disease.</i>	<i>Date of Operation.</i>	<i>What Nerve.</i>	<i>Meckel's ganglion removed. If so, how?</i>	<i>Duration of Relief.</i>	<i>Length of Nerve Removed.</i>	<i>Remarks.</i>	<i>Reference.</i>
48	Heiling.	F. 68.	2 years.	May 17, 1878.	Infra-orbital.		1 year and 2 mos.	Trunk.	Cured. No relapse to date of report.	K. K. Krank- enanstalt in Wien. 1881
49	Michel.	M. 45.	15 years.	1878.	Infra-orbital and dental. Inf. dental. Buccal.	No.	5 months.	2 cm. of each.	Complete relief.	Jacquot, cit.
50	Brown, A.	F. 56.	Over 10 years.	May 11, 1880.	Inf. dental.			1/4 inch.	Entire freedom from pain from date.	British Med. Jour. 1880. Vol. II.
51	Jenkins, R. S.	M. 52.	1 year.	Aug. 10, 1880.	Infra-orbital.		Free up to date of re- port.	Portions with branches.		South. Med. Rec. 1880.
52	Englisch.	F. 30.	8 years.	Sept. 25, 1880.	Infra-orbital.	No.		1 1/2 inchi.	Complete relief.	Bericht der K. K. Krank- enanstalt in Wien. 1881. page 322.

53	Brok, J. B.	M. 67.	6 years.	Nov. 15, 1880.	Sup. maxil- lary.	Yes.			Entire trunk.	Complete cure.	Mich. Med. News, Vol. IV. No. 1.
54	Wier, R. F.	M. 47.	2 years.	Feb. 23, 1881.	Sup. maxil- lary.	Yes.	Free to date of report.	$\frac{3}{4}$ inch with branches.		Cured. 2 years before operation nearly an inch of sup. maxillary was resected. This was fol- lowed by constant pain for 2 months, and then followed en- tire relief for 6 months.	Med. Gazette. New York. 1881.
55	Morton.	M. 56.	3 or 4 years.	April 13, 1881.	Inf. dental.			Not stated.		"Excellent recovery."	Med. Times. Philadelphia 1880.
56	Morton.	M. 71.	9 years.	Mch. 21, 1881.	Inf. dental.		Free to re- port.	$\frac{1}{2}$ inch.		A few days after operation had 3 or 4 twinges of pain. For a month afterward and up to date of report remains well.	do.
57	Gerster.	M. 36.	18 years.	May 12, 1881.	Sup. maxil- lary.			$\frac{1}{8}$ inch.		Neurectomy in front. infra-orbital foramen previously done, with but temporary relief.	N. Y. Med. Jour. Jan. 22, 1884.
58	Davis, E. P.	M. 43.	6 years.	May 28, 1881.	Sup. maxil- lary.	Torn out.	9 months.	$\frac{1}{2}$ inch.		Relieved until winter of 1881-82, when pain returned in infra- dental nerve and about eye.	Chicago Med. News. Vol. IV.
59	Morton.	F. 43.	5 years.	May 31, 1881.	Inf. dental.			$\frac{1}{2}$ inch.		When last heard from was free from pain.	Med. News. Philad. 1882.

TABULATED STATEMENT OF CASES OF NEURECTOMY FOR RELIEF OF FACIAL NEURALGIA. *Continued.*

<i>No. of Case.</i>	<i>Operator.</i>	<i>Sex and Age.</i>	<i>Duration of Disease.</i>	<i>Date of Operation.</i>	<i>What Nerve.</i>	<i>Meckel's ganglion removed. If so, how?</i>	<i>Duration of Relief.</i>	<i>Length of Nerve Removed.</i>	<i>Remarks.</i>	<i>Reference.</i>
60	Rocher.	M. 60.	16 years.	July 19, 1881.	Infra-orbital.		10 months.	4 cm.	Pains returned but not so severe. Previous to operation neurectomy had been done 5 times, 3 times with relief for 2 years, and the last with relief for 10 months.	
61	Wallace.	M. 34.	9 years.	Oct. 14, 1881.	Supra-orbital	Presumably, as nerve was removed at foramen rotundum and for 2 inches		2 inches.	Pain continued for a few days, then ceased entirely for a week, when it appeared along lower jaw, but not in portion of face previously affected.	Pittsburgh Med. Jour. Vol. II, No. 10, 1882.
62	Wallace, W.	M. 34.	9 years.	Nov. 1, 1881.	Inf. dental.		10 months.	2 1/2 inches.	Pain for a few days, then ceased. Since has been entirely free from pain except during 2 or 3 days owing to exposure to cold.	do.
63	Vanderveer, A.	F. 37.	1 year and 2 mos.	Jan. 2, 1882.	Inf. dental.		11 months.	Not stated.	Almost immediate relief.	Med. Annals. Albany, N. Y. Vol. IV, No. 9.

64	Gerster.	F. 42.	2 years.	Jan. 19, 1882.	Sup. maxillary at foramen rotundum.	Yes.	1-2 months.	1 $\frac{3}{4}$ inches.	In rather more than a year after operation had slight pain in upper lip.	N. Y. Med. Jour. Jan. 12, 1884.
65	Lange, F.	M. 40.	"Long time."	March, 1882.	Sup. maxillary at foramen rotundum.	Yes.	2 years.	Trunk.	Free up to date of report.	do.
66	Gunn.	M. 44.	2 mos.	April 22, 1882.	Inf. dental.			1 $\frac{1}{4}$ inches.	Some pain for about 3 weeks after operation. Now free from pain but notices uneasy sensations during cold and damp weather.	Chicago Med. News, Vol. IV, No. 7.
67	Gerster.	M. 63.	2 years and 9 mos.	Aug. 30, 1882.	Sup. maxillary.	Yes.	2 years.	1 $\frac{1}{4}$ inches.	Free to date of report.	N. Y. Med. Jour. Jan. 12, 1884.
68	Maclean.	M. 65.		Oct. 21, 1882.				Not stated.	Cured.	Phys. and Surg. Ann Arbor, Mich. Vol. IV, No. 2.
69	Chavasse.	M. 50.	14 years.	Oct. 3, 1882.	Sup. maxillary.	Yes.		1 $\frac{3}{4}$ inches.	Complete cure.	Med. Chirurg. Trans. Vol. LXXV I I. 1884.

TABULATED STATEMENT OF CASES OF NEURECTOMY FOR RELIEF OF FACIAL NEURALGIA. Continued.

No. of Case.	Operator.	Sex and Age.	Duration of Disease.	Date of Operation.	What Nerve.	Meckel's ganglion removed. If so, how?	Duration of Relief.	Length of Nerve Removed.	Remarks.	Reference.
70	Maclean.	M. 64.	12 years.	Oct. 16, 1882.	Infra-orbital and ment. branch of inf. dental stretched and excised.			"Portion."	Complete cure.	Phys. and Surg. Vol. IV, No. XI, 1882.
71	Gardner, Wm.	M. 65.	5 years.	Nov. 10, 1882.	Inf. dental.			1/2 inch.	Complete cure.	Australian Med. Jour. Vol. V, M. 3, 1883.
72	Chavasse.	M. 46.	11 years.	Feb. 9, 1883.	Sup. maxillary.	Uncertain owing to hemorrhage.	Remains free.	1 1/2 inches.	Cured.	Med. Trans. Vol. LXVII, 1884.
73	Howe, J. W.	F. 45.	12 years.	May 29, 1883.	Sup. maxillary.	Yes.	Free to date, 1 year.		Slight pain when exposed to sudden changes of temperature.	Med. News. Philadelphia. Jan. 12, 1884.

74	Gerster.	M. 38.		June 16, 1883.	Sup. maxillary at foramen rotundum.	Yes.				For a few days after operation had severe pains, but patient did well, the pains not returning. Has since had slight pains in upper lip.	N. Y. Med. Jour. Jan. 12, 1884.
75	Mears.	F. 50.	8 1/2 yrs.	Aug. 27, 1883.	Inf. dental.			Free to re- port, 1 year.	3 inches.		Med. News. Philadelphia. July 19, 1884. Page 58.
76	Fowler, G. R.	M. 53.	3 mos.	Mch. 20, 1884.	Sup. max. beyond Meckel's ganglion.	Yes.		1 year and 8 months, or longer.	Entire trunk.	Cured.	Med. Record. N. Y. Vol. 26. Page 369.
77	Rockwell, F. W.	F. 16.		May 8, 1884.	Sup. maxillary.	Yes.			Entire trunk.	Cured.	Annals of Surgery. Vol. 1, No. 4. April 1885.
78	Fowler, G. R.	M. 45.	3 years,	Nov. 3, 1884.	Sup. maxillary.	Yes.			Entire trunk.	Cured. Had pain, slowly lessening and referred to infr. max. division. This disappeared by Jan. 1st.	Records of St. Mary's General Hospital. Brooklyn, N.Y. 1885.

TABULATED STATEMENT OF CASES OF NEURECTOMY FOR RELIEF OF FACIAL NEURALGIA. *Continued.*

No. of Case.	Operator.	Sex and Age.	Duration of Disease.	Date of Operation.	What Nerve.	Meckel's ganglion removed. If so, how?	Duration of Relief.	Length of Nerve Removed.	Remarks.	Reference.
79	Fowler, G. R.	F. 30.	For several yrs. at intervals.	Feb. 4, 1884.	Supra-orbital		1 year and 9 mos. from operation (present date) remains well.	Supra-orbital back of supra-trochlear branches; distributed to the forehead.	Cure. Pain ceased at once and has not returned up to present date, Nov. 1, 1885.	Med. Record. N. Y. Vol. 26, p. 359.
80	Fowler, G. R.	M. 38.	20 years.	Nov. 13, 1884.	Sup. maxillary.	Yes.		Trunk beyond Meckel's ganglion.	3 years before facial nerve had been stretched, and relief for one week. After the operation here recorded immediate relief of pain. On 7th day left hospital, the sutures still remaining in situ, in spite of remonstrances of my house surgeon. On the 17th day after leaving hospital word was received at the institution that he had died of tetanus, which developed a few days before. The day he left the hospital was damp and cold.	Records of St. Mary's General Hospital. Brooklyn, N.Y. 1885.

81 Croft.	Sex not stated.			Infra-orbital and stretched.			$\frac{3}{8}$ inch.	For a time pain and muscular spasms persisted, then subsided and he was free from pain. 6 months later had an attack of gout, which was followed by convulsive neuralgia, which also subsided. After another 6 months the pain again returned, and to it succeeded permanent relief.	
82 Markoe.	M. Age not stated.			Sup. maxil- lary and part of branch to Meckel's ganglion.	No.	3 years.	Trunk.	Neurectomy of infra-dental previously. In 3 years supra-orbital neuralgia appeared, but not severe.	N. Y. Med. Journ. Jan. 12, 1884.
83 Bull, W. T.	M. 62. Several years.		Aug. 11, 1884.	Sup. maxil- lary.		15 months (to date).	$\frac{3}{4}$ inch.	One week after $\frac{3}{4}$ inch of inf. dental nerve was removed. Relief up to date.	N. Y. Med. Jour. Nov. 28, 1885.

The facts as here presented, although they do not bear out the brilliant anticipations once held as to the future of neurectomy, yet are such as to give surgeons quite as much confidence in this as in other operations when but a remote hope of cure can be held out, and which must be necessarily but palliative in the large majority of cases. Operations for carcinoma are not withheld from patients when periods of relief varying from one to three years can be promised, and no surgeon would be justified in refusing to operate, other measures of relief failing, upon the victims of this source of terrible suffering. Any one who has witnessed the contortions and grimaces of the muscles of expression upon the accession of a paroxysm of pain in one of these cases could not fail to have his deepest sympathies excited in behalf of the sufferer; any method of dealing with such agony, which, by a single stroke could palliate its fierceness and hold it in abeyance, if but for a brief period, is worthy of trial. In this sense alone neurectomy in properly selected cases is not only justified, but most imperatively demanded. The question as to whether it should be performed at once, or constitute the ultimate refuge of the tormented victim may not yet be settled, but that it holds out hope for the otherwise hopeless no one can deny.

It is not my intention to treat of the special operative technique of neurectomy, but there is one method of operation for which the application of a special principle is claimed, and which calls for more than a passing notice. I refer to the operation of neurectomy of the superior maxillary or second division of the fifth, with extirpation of Meckel's ganglion, instituted by Carnochan.

In a most able article upon the subject of the importance or otherwise of removing Meckel's ganglion for the relief of neuralgia of the fifth cranial nerve, Prof. Conner¹ reviews the subject of the anatomy and physiology of the parts involved in the so-called "Carnochan's operation." Basing his conclusions upon a study of thirteen cases reported up to the time of the appearance of his paper, he concludes that, inasmuch as freedom from pain did not continue more than a year and a half

¹ American Journal of the Medical Sciences, October, 1870. Page 359.

after removal of the ganglion, simple neurotomy (?) gave a period of relief as great, or nearly so, as those in which the ganglion had shared in the excision. Prof. Conner evidently has not separated the cases operated upon by nerve section from those in which a neurectomy had been performed. He quotes Wagner and others as having given periods of relief ranging from eight to fourteen months by excising portions of the nerve trunk ranging from "eleven to eighteen lines and a half." These were cases of neurectomy and should be classed as such.

There can be no question that Carnochan's assertion that the removal of the ganglion constitutes the "key of the operation," was founded upon insufficient observation; and his assertion that this collection of gray matter could be with propriety likened to a galvanic battery, keeping up a continual supply of "morbid nervous sensibility," is hardly to be considered as being founded upon a proper appreciation of the function of this ganglion. Prof. Conner has so ably set forth the other objections to a performance of this part of the operation, except as a means of assuring the total excision of the nerve to the foramen rotundum, that theoretically, at least, it would seem, if the nerve and all of its branches could be excised in cases in which the disease was of peripheral origin, and the sphenopalatine ganglion remained undisturbed, that a more rational procedure would be substituted for a formidable operation, and, in the case of the latter, one not free from danger. But the impossibility of achieving a neurectomy of the entire nerve, including the palatine and posterior dental branches, without sacrificing the ganglion, will be apparent at a glance, when the very narrow space through which the foramen rotundum is reached and the difficulty, owing to insufficient light, of identifying the parts satisfactorily, are taken into consideration.

From the table of neurectomies, I have separated twenty-six cases of excision of the infra-orbital or superior maxillary division of the fifth nerve in which the sphenopalatine ganglion was either removed, broken up or otherwise destroyed, for purposes of study and comparison. These include cases numbered 1, 2, 3, 13, 21, 22, 26, 31, 33, 34, 37, 42, 53, 54, 58, 61, 64, 65, 67, 69, 73, 74, 76, 77, 78 and 80. In summarizing these cases

the following points are presented for consideration. In the first place it will be at once seen that the cases subjected to this method of operating were by no means trivial in character. The average duration prior to operation was certainly as long, and the ages of the patients and other circumstances were of a character as unfavorable to recovery as in the other cases of excision of the infra-orbital nerve in which a more or less extensive neurectomy was performed, but without removal of the ganglion.

1. Total number of cases in which Meckel's ganglion was removed, 26.
2. Number of cases in which relief continued for three years or longer, 3.
3. Number of cases in which relief continued for two years but less than three years, 6.
4. Number of cases in which relief continued for one year but less than two years, 9.
5. Number of cases in which relief continued for six months but less than one year, 3.
6. Number of cases in which relief lasted less than six months, 5.
7. Average duration of relief, one year, five months, sixteen days.

From the same table twenty-six cases of simple neurectomy of the infra-orbital nerve or superior maxillary division have been taken including cases numbered 15, 18, 20, 24, 25, 27, 28, 29, 30, 32, 35, 36, 38, 40, 43, 44, 46, 47, 48, 51, 52, 57, 60, 70, 81 and 82 and 83. These are of about the same average duration and severity; certainly no partiality can be said to have been shown in these respects towards the first series of cases; the results of a study of these cases may be summarized as follows:

1. Total number of cases of neurectomy of the infra-orbital nerve, 26.
2. Number of cases in which relief continued for three years or longer, 5.
3. Number of cases in which relief continued for two years but less than three years, 3.
4. Number of cases in which relief continued for one year but less than two years, 7.

5. Number of cases in which relief continued for six months but less than one year, 7.
6. Number of cases in which relief lasted less than six months, 4.
7. Average duration of relief, one year, three months, fifteen days.

In thirteen cases the entire nerve trunk was removed from beyond Meckel's ganglion. In three cases the proximal nerve was removed for more than an inch from the foramen rotundum, and less than the entire trunk. In one case less than an inch, including the ganglion, was excised. In four cases the length of the nerve trunk removed, besides the ganglion, was not stated. As a rule, the longer periods of relief after the operation are among those cases in which the entire nerve trunk was removed from beyond the ganglion. On the other hand, the question as to whether this longer duration of relief depended upon the removal or destruction of the ganglion, or the fact that a more extensive neurectomy was done in these cases, is still an open one. No satisfactory estimate can be made as to the duration of relief in these cases, for the reason that the reports are sometimes made within a few months after the operation. How many of these continue up to the present time free from pain, upon the one hand, or upon the other, relapsed after being reported as cured, it is impossible to say.

Physiologists now consider the spheno-palatine ganglion, as well as the other three cranial ganglia as belonging to the sympathetic system. This is the largest of these and receives its sensory root from the fifth, through the spheno-palatine branches of the superior maxillary division. The branches of distribution of the ganglion, like those of the sympathetic generally, are distributed largely to mucous membrane. The gums, hard and soft palate and nasal cavity are supplied by this distribution. These are the situations most exposed to influences provocative of attacks of pain: and it is thought that through this distribution are to be explained those cases in which attempts at mastication and deglutition produce the paroxysms. This of course, would imply a diseased condition of the ganglion itself, and that too, perhaps, by means of continuity and extension from the fifth, through its sensory roots. It is

difficult to understand how this could occur when the difference in structure in the nerve fibres on the one hand, and the nerve cells of the ganglion, which latter resembles those of the encephalon, upon the other, are taken into consideration. That the sympathetic system is endowed with sensibility is now generally conceded, although it must be acknowledged that this is not present in so high a degree of development as in the case of the cerebro-spinal system. The ganglion itself may not be possessed of great sensibility, for both Claude-Bernard and Prevost have torn it out without producing apparent pain: yet it may serve as the medium through which impressions are reflected and produce their effect upon the sensorium. The history of one of my cases seems to point particularly to an extremely sensitive condition of the area of distribution of the branches from the ganglion upon the mucous membrane. The case was that of a Swede, (No. 80 of the table) who, for twenty years had suffered from a neuralgia referable at first to the distribution upon the face of the infra-orbital. Later on, the mucous membrane lining the nose, mouth and hard and soft palate became so exquisitely sensitive that he could not bear the slightest impression. Every attempt to receive food upon that side of the mouth was followed by exacerbations of pain of the most frightful character. It was only by lying upon the opposite side and having a funnel passed back to the pharynx so as to guide the stream away from the diseased side, that he was enabled to take food at all, and that of a liquid character only. It is fair to say that impressions, however slight, such as, for instance, that of a fly alighting upon the surface of the integument in the area of distribution of the infra-orbital nerve, would likewise initiate a similar attack. The removal of the nerve and ganglion in this case at once and completely arrested the symptoms, and although he perished afterwards through his own temerity and fool-hardiness, for the balance of his life he experienced immunity from pain such as he had scarcely known within his recollection.

In any event, it seems rational to conclude that the neurectomy should be sufficiently complete to include as much of the nerve as possible. Hueter¹ states that experiments made

¹Grundriss der Chirurgie, Vol. I, p. 444.

upon the lower animals demonstrate that it is necessary in them, to include a portion of the nerve not less than five inches in length, in order to prevent, with certainty, reunion. It is manifestly impracticable to remove so large a portion of the nerve trunk in the case of the branches of the trifacial, and therefore, some other means of achieving the same result would be very desirable. Hueter suggests that bruising the ends of the nerve stumps might answer, but fears that an ascending neuritis might be set up, which, extending to the central organ, might there set up changes, which, in their turn, would be the cause of a repetition of the neuralgia. The suggestion that touching the central end of the nerve stump with the point of the thermo-cautery might be of service, both in preventing reunion, as well as controlling to some extent the resulting neuritis, seems to be a good one. This was stated to have been done in at least one case recorded in the table (Dumont's, No. 37).

NERVE-STRETCHING.—This operation is a comparatively modern method of treatment of neuralgia. The credit of having been the first to suggest it is generally ascribed to Billroth¹, who, in 1872, related a case of epileptiform attacks which were thought to have their origin in an injury to the right sciatic nerve near the tuber ischii, and which he cured by laying bare the nerve for upwards of eight inches and stretching it at several points. Prof. von Nussbaum², of Munich, however, reduced the procedure to a methodical operation as applied to neuralgia. The cases in which it would seem to have had its greatest applicability are those in which the large nerve trunks are involved, such as the sciatic, although it has not been confined to such cases. It is not easy to estimate, at the present time, its precise value in cases of neuralgia of the trifacial. In this, as in all other measures for the relief of the class of cases under consideration, the length of time which improvement lasts, or immunity from pain continues, enters as a very important factor in the study of the subject. For this reason a neglect to state how long patients, designated as cured, were kept under observation, has invalidated many of the cases thus

¹Archiv. f. klinisch. Chirurgie. XIII, p. 379-395.

²Deutsche Zeitschrift für Chirurgie. 1874.

far collected. This is notably true of the cases tabulated by Dr. Chandler¹, and also of those collected by Dr. Harte for Prof. Agnew². Every one is familiar with the fact that the most surprising arrest of the pain of facial neuralgia will follow decided impressions upon the mind, but cases apparently benefited by purely psychical influences very rarely continue improved, and in a comparatively short time relapse into their old state. It is equally well known that all therapeutic measures may do well for a time, but a tendency to relapse is the rule. In the absence of any reliable data upon which to base a rational theory as to the action of this operation, and even taking into account the short space of time during which improvement continues in many cases where the operation has been performed upon the sensory branches of the face, it will still be necessary, perhaps, to look further than a psychical effect to account for the brief period of rest. In the case of the larger nerve trunks, where a much greater exercise of force would be justifiable, as for instance, in the sciatic, one can easily see that the traumatism inflicted might lead to a degeneration, in a greater or less degree, of some of the nerve tubules or a molecular change extending to the central organs of the nervous system. Here, doubtless, the effects of the stretching are felt by the nerve for a much greater distance than could be possible in a nerve like the supra-orbital, for instance, which would give way before the stretching could influence the parts beyond the immediate vicinity of the point laid bare in the operation wound.

Hahn,³ of Berlin, stretched, in eleven consecutive cases, one or another of the branches of the fifth nerve for neuralgia. Eight of these, although apparently cured, relapsed after six or eight months, yet had they been reported within half a year from the time of operation, all would have doubtless been set down as cures. Of the three remaining cases, two are reported by him as failures from the beginning, and the third remained improved, although not cured. In this latter case, it is worthy of note, the nerve was resected, as well as stretched,

¹Medical Record, New York.

²Principles and Practice of Surgery Vol. III p. 413.

³Chandler's Tables.

and it is fair to assume that the improvement may have been due, in some measure, to the neurectomy. To sum up this operator's experience in nerve-stretching, as applied to the divisions of the fifth, it may be said that he gave eight of his patients more or less immunity from pain for periods of time the longest of which did not exceed eight months, while in two no relief followed; in one case, although complete relief did not take place, yet a permanent improvement, which might have been due to the conjoined neurectomy, resulted.

Another case, that of Croft, also to be found in Chandler's tables, and reported as cured by nerve-stretching, was subjected to the operation of neurectomy in addition to the nerve-stretching, and the result may have been favorably influenced by the cutting operation. It should also be noted that this is the only case reported in this tabulation of cases in which the statement that a cure took place was based upon an observation of the patient for more than a year after the operation. This fact, taken in connection with Hahn's relapsed cases, is of especial significance. In all the other cases quoted by both Chandler and Agnew, in which the length of time the patient remained under observation was noted, the longest did not exceed seven and a half months. With the well-known tendency to relapse in these cases, no patient should be considered as cured until at least the average time during which relapses takes place, has passed.

Turning now to the tables of Dr. L. C. Gray¹, who endeavored to glean from the numerous articles upon the subject data sufficient to base an opinion upon the value of nerve-stretching in chronic trigeminal neuralgia, we find the cures tabulated in such a manner as to lead one, at first glance, to form a rather favorable opinion of the operation. But it will be at once seen that the only case sufficiently complete in its history to be at all worthy of consideration as a case cured, is that attributed to Spence. In this case the patient was reported to be free from pain eight months after the operation. The remaining seven cases were only under observation for periods ranging from three weeks to two months. Referring

¹Journal of Neurology and Psychiatry, May, 1882.

to his table the author very pertinently observes: "It is claimed that all these were cured; but in only one case is there positive proof of this statement," alluding to the case of Spence.

Upon the introduction of nerve-stretching it was thought that, for neuralgia of the fifth, of central origin at least, the excision of the nerve would be held in reserve for cases in which the lesser operation failed to give relief. It would therefore seem a rational proposition to make trial of all other measures, including nerve-stretching, and if these fail to give relief, then the performance of a neurectomy would certainly be indicated. It is probably a fact that most operators, in those cases in which an excision of a portion of the nerve only was performed, made more or less traction upon the nerve with the view of bringing as much of the nerve trunk as possible within reach, thus unconsciously performing a nerve-stretching, as well as a neurectomy. This has been particularly true of operations of excision of the infra-orbital nerve at its emergence from the infra-orbital foramen, as well as of the inferior dental at the mental foramen, and the inferior maxillary, when the method of either Kühn or Hueter is employed. In the case of the latter trunk, particularly, it will be found, if the experiment be made upon the cadaver, that a considerable dragging in an upward direction is necessary in order to bring the nerve into position to be readily reached and excised from its position within and behind the angle of the lower jaw. In the cases in which excision of the inferior dental nerve has been done in some part of the inferior dental canal, after opening the latter, in order to excise as much as possible of its trunk it is advised to make forcible traction upon the same. The trunk has been torn off in this attempt, and it seems to be not altogether improbable that the influence of the forcible stretching which this manipulation involved was felt along the whole course of the nerve trunk. According to Hildenbrandt¹, this accident occurred to no less careful an operator than Sedillot. In fact, this forcible traction upon the nerve occurs in almost all of the commonly performed neurectomies upon the tri-

¹ *Nervendendehnung, Neurektomie und Nervennaht.* Berlin. 1884

facial, whether upon the supra-orbital by Leinhardt's method; the infra-orbital by Wagner's operation of making strong tension upon the nerve before making the section close to the bone; or in neurectomy of the lingual, in which the nerve is caught upon a strabismus hook and brought well into view before the section is made. Hansen¹ recommends forcible extension upon the spinal accessory prior to an excision of a portion of its trunk, and P. Vogt² proposes to combine nerve-stretching and neurectomy as a formal operation in properly selected cases.

The above facts forcibly suggest to the mind of the practical surgeon the possibility of achieving as good a final result from nerve-stretching, either with or without a conjoined neurectomy, as from the operation of neurectomy of the entire nerve trunk, where accessible. Further experience in nerve-stretching may serve to confirm this, and it is suggested that, as the operation becomes more extensively practiced, and cases are recognized in which it alone is applicable, and which are submitted to it, it will be found to possess advantages which will place it among recognized operative measures for the relief of this class of sufferers. I venture to predict, however, that the greatest barrier to its frequent performance upon the tri-facial, compared to its application to the sciatic will be found in the anatomical difficulties in the way of exposing more than a comparatively small portion of the trunks of the divisions of the fifth nerve without considerable mutilation of the face. To the patient the operation will seem as grave a matter as neurectomy itself, and, in fact, it is quite as serious an undertaking, if sufficient of the nerve is exposed to make the operation complete and effectual.

CAROTID LIGATION.—The arrest of arterial blood supply, as a means of cutting short paroxysms of trigeminal neuralgia was practiced by Trousseau. His plan was to first perform an arteriotomy, in the case of small vessels, such as the temporal and occipital, and to subsequently employ compression. He is said to have met with some brilliant successes by the employment of this method, particularly in neuralgias of the

¹Arch. de Physiol. norm. et path. Paris. 1881.

²Hildenbrandt, Op. cit.

nerves of the temporal region and scalp. Von Nussbaum¹, however, in 1858, after having performed various neurectomies and other operations for the relief of an intractable prosopalgia without avail, was compelled, on account of persistent hæmorrhage, resulting from one of these latter, to place a ligature upon the common carotid of that side. The patient, a pregnant female, perished from recurrent hæmorrhage from the wounds, after aborting, but von Nussbaum seems to have been so encouraged by the suggestion of the possibility of favorably influencing the neuralgia by this procedure that he repeated the operation in four other instances. That success should have attended these efforts is not a matter of surprise, when the decided changes, occurring both in the nerve trunks together with their distribution, and in the central organs of the brain, through arrest of the nutrient supply, are taken into account.

The following abstracts of cases of ligature of the carotid for neuralgia of the trifacial have been compiled from the published reports of cases occurring up to this time, accessible to me:

CASE I². F., æt. 38. Duration ten years. February, 1858, removal of one line of supra-orbital, infra-orbital, inferior alveolar and mental nerves. Relief.

July.—Pain again, relieved by loosening up the cicatricial tissue at lower edge of orbit. October.—Pain in inferior maxillary region. Trephined the ascending ramus of the inferior maxillary bone and removed four to five lines of inferior alveolar, mylo-hyoid and lingual nerves. Relief for nine months. Pain returned. Supra- and infra-orbitals again divided, removing one.

January 1860, the cicatricial tissue formed by trephining was removed. Ten months' relief. Then great pain on whole left side of face. The patient was three months advanced in pregnancy.

October 29, 1860.—Yielding to her urgent entreaties, the cicatricial tissue was removed from the scars of the previous operations, a triangular piece cut out from the superior maxillary, opening the infra-orbital canal and incising the nerve far back. Bleeding from this and from lower jaw was excessive, yielding to styptics and tamponing the wounds.

¹Aertzliches Intelligenz-Blatt, vol. x., p. 461.

²Von Nussbaum. Article by Bratsch, *Aerisliche's Intelligenz-Blatt*. August 15, 1863, vol. x., p. 461.

October 31.—Hæmorrhage renewed.

November 2.—Ligated common carotid. Patient free from pain and appeared to improve.

November 3.—Miscarriage.

November 4.—Hæmorrhage recurred in wounds and the patient died.

CASE II¹. F., æt. 22. Several months' duration of disease.

June 12, 1861.—Resection of one inch of supra-orbital. No relief.

August 20.—Cut out scar and resected infra-orbital. Relief incomplete.

February, 1862.—Accessions of pain with opisthotonos.

February 28, 1862.—Cut out scars, trephined and resected, as in preceding case. Quick recovery, but no relief.

March 9, 1862.—Tied common carotid. Relief complete. Slight paresis of extremities on affected side for fourteen days, disappearing when temporal pulsation returned.

CASE III². M., æt. 40. Duration for a long time—beyond memory of patient, who is mentally deficient.

October 22, 1862.—Resection infra-orbital. Pain recurred in eight days.

October 30, 1862.—Tied common carotid, loosened cicatrix of infra-orbital, resected supra-orbital and temporal, and performed the trephining and resection as in case No. 1.

Patient lay eight days in stupor, suddenly returned to consciousness, free from pain. Twelve hours after operation complete paralysis of left side was noticed. This continued for four weeks, when sensation returned; then, by degrees, motion. Complete relief. Is able to walk long distance. No return of paralysis or improvement in intelligence.

CASE IV³. F., æt. 38. Duration, nine years. In 1860—Supra- and infra-orbital cut several times. Infra-orbital at last resected.

June 25, 1861.—Cicatrices cut out. Relief incomplete.

January 13, 1862.—Cicatrices again cut out. Relief for several months.

November 8, 1862.—Common carotid ligated. No result.

November 29, 1862.—Cicatrices cut out. Slight relief.

CASE V⁴. F., æt. 60. Of several years' duration.

¹ Bratsch. Opt. cit.

² Bratsch. Op. cit.

³ von Nussbaum, reported by Bratsch, op. cit.

⁴ von Nussbaum, reported by Bratsch, op. cit.

September 28, 1860.—Resection one-half supra- and infra-orbital and occipital. Relief but slight. Bitter taste in mouth.

December 7, 1862.—Tied common carotid, loosened cicatrices, resected superficial and deep temporals, trephined and resected as in Case No. 1. Pains more endurable and confined to a spot over the right temporal bone.

CASE VI¹. F., æt. 56. Of many years' duration. In 1853, a period of relief, covering six years, was obtained by a neurectomy of the right infra-orbital. Then neurectomy of the left infra-orbital was done. In six years recurrence of pain, for which inferior dental was excised and mental foramen cauterized. Six months' relief followed this.

April 9, 1866.—Ligature of left carotid. Ligation revealed atheroma at the bifurcation. Complete relief. (Case reported eleven days after operation).

CASE VII². F. Mother of five children. Healthy up to 37th year. Then rheumatic affections. Subject to many great changes of temperature in her daily duties as mistress of an inn. Section infra-orbital (1851?).

Relief for fourteen years. In 1865 recurrence in mental, infra-maxillary and infra-orbital of other (left) side. Excision of these. Only temporary relief. Tied carotid September 14, 1865. Complete relief from neuralgia. Troubled with rheumatism in bad weather. Patient died in 1876 from carcinoma. Autopsy refused.

CASE VIII³. M., æt. 45. Duration of ten years with intermissions. Removal of a molar tooth from upper jaw gave relief for three weeks, Gross' operation of exsection of the alveolar process, done in 1871, gave relief for five months. A neurectomy of the inferior dental gave relief for three years—carotid ligated June 30, 1877. This is the third time this patient has been reported cured.

CASE IX⁴. M., æt. 41. Professor Salzer operated by neurectomy of infra-orbital in 1870. Recurrence in eight months. Ligation carotid May 14, 1871. Temporary relief. Recurrence in eight months. Patient found relief from chloral hydrate. Thought to obtain more relief, so took three ounces at one dose. An antidote was immediately given. The toxic symptoms were checked, but hyperæmia of the left conjunctiva and panophthalmia set in. Rapid keratitis and loss of

¹ Patruban, K. K. *Gesellschaft der Aertze in Wien*, April 20, 1866.

² Patruban, Allg. *Wiener Med. Zeitung*, Nov. 28, 1876, XXI, pp. 421, 429 and 442.

³ Hutchison, *Med. News*, Phila., April 11, 1885.

⁴ Patruban, Allg. *Wiener Med. Zeitung*. 1876.

sight in thirty-six hours. This was on the side where the ligation occurred. The author suggests that the inflammation was caused by defective functional activity of the vaso-motor nerves, which was probably an effect of the previous ligation. Since the loss of that eye the patient has felt only occasional "reminiscences" of pain, easily controlled by hypodermics of morphia.

CASE X¹. F. Age not given ("young and blooming"). Always healthy and strong; in 1870-'71 troubled with hyperæmia of right side of face, with feeling of heat and dryness. This was followed after awhile by boring and darting pains along branches of the fifth nerve. This was accompanied by injected conjunctiva, lachrymation, tinnitus, slight salivation and muscular twitching, and a hyperæsthesia so great that the slightest touch to the skin or confinement of a bandage or even placing the tongue to the lips brought on accession of neuralgic pain. Operation December 24, 1871. Instant and complete relief to date.

CASE XI². F., æt. 32, wife of an officer. Had accompanied him in Italian campaign of 1859, contracting by exposure rheumatism. Infra-orbital neuralgia right side. Neurectomy. Fourteen months' relief. Neuralgia of infra-maxillary. Neurectomy (Paravicini's method), two years' relief. Diffuse neuralgia. Hyperæmia of face and scalp, followed by puffiness and circumocular œdema. Ligation of carotid. complete relief.

CASE XII³. F., æt. 63. Without prodromes, commenced in 1863 to have tearing pains in right jaw. Drawing teeth did not alleviate. Neurectomy of infra-orbital. Relief for nine months, then return of pain in supra-orbital and infra-maxillary nerves of that side. No painful points. Ligated carotid. Relief for four years. Then recurrence, but in milder form. Subcutaneous injections relieved the pain somewhat, but it was associated with spots of local hyperæmia. Scarification of these gave sufficient relief so that the patient could chew and swallow.

CASE XIII⁴. (Described also by Prodratzky in his work on neuralgia, as he saw the patient).

M. Young soldier, contracted rheumatism in 1859, whence infra-orbital-neuralgia. Resection. One year later, recurrence. Repeated resections were unavailing. Ligation carotid. The operation was very difficult, the anæsthesia incomplete and the patient struggling

¹ Patruban. Op. cit.

² Patruban. Op. cit.

³ Patruban. Op. cit.

⁴ Patruban. Op. cit.

throughout. Recurrence after thirteen months. Repeated resections of cicatrices of no avail.

Podrazky operated after Carnochan's method, cutting the nerve at the foramen rotundum. An immediate examination of the resected nerve showed no pathological changes worth noting. The operation was quickly recovered from, but gave only temporary relief.

CASE XIV¹. M. In 1872 cut infra-maxillary by Paravicinis' method (denuding posterior border of ascending ramus of infra-maxillary, sawing off a plate of bone on inner side with fine saw so as to reach the infra-orbital canal, isolating and resecting nerve). Recurrence in one year in all branches of fifth. Ligation of carotid. The operation affected the patient so little that on his afternoon visit, six hours after operation, he was found drinking coffee and playing cards with some friends in a neighboring coffee house. Recurrence in eleven months, on same side. Resection at foramen rotundum. Complete relief. After a year had some slight variable pains from time to time. Lost sight of since.

CASE XV². M. Capuchin monk. In June, 1866, stated that he had had neuralgia for eight years. Hyperaemia and local burning right side face. Then boring and tearing pains of so great severity as to cause him to swoon while officiating at mass or confessional. Then hemicrania and twitching of muscles of face. He supposed the affection to be caused by exposure to cold in the cloister or refectory. Determined upon tying carotid, and advised him to go to hospital for the purpose. He preferred to remain in a cell of the cloister. Operation at physician's residence, thence removed to cloister six hours after operation. Visited him next day and found him doing well; was obliged to leave him for five days, when was astonished to find that erysipelas had set in and that pyæmia was imminent. The patient stated that he had been lying neglected in his cell and could scarcely obtain a drop of water. Although the weather was warm it was at the time favorable to the healing of wounds, as the many cases of wounded soldiers then in the city amply showed. The cleansing of the wound had been too long delayed. Patient died.

CASE XVI³. M., æt., 49. Disease of thirty years' duration. Carotid ligated June 10, 1878. No cerebral symptoms. No relief to pain. A subsequent neurectomy of infra-orbital gave two and a half months' relief. Pain returned in inferior maxillary division.

CASE XVII². M., æt. 64. Prosopalgia right side. First attack in

¹ Patruban. Op. cit.

² Patruban. Op. cit.

³ Hutchison. Op. cit.

⁴ F. H. Gross, *American Journal Med. Sciences*, April, 1883, vol. 85, p. 366.

August, 1873. Extraction of decayed teeth and hypodermics of morphia. Relief for three years. A second attack in 1876, which lasted three months, and slowly yielded to electricity. In June, 1880, a third attack. Compression of carotid gave relief. Ligation August 9, 1880. Immediate relief in area of distribution of first and second divisions. Pain has never returned in the first division. Second division remained free for fully two years. The effect on third division "too transient to count for anything." Neurectomy of inferior dental eight months later, resulting in relief for a year and a quarter. Then neurectomy of superior maxillary and repetition of last operation. Relief complete. Patient seen in February, 1883, at which time he was still free from pain.

CASE XVIII¹. Left parotid a tumor, which was thought to be the seat of an intense neuralgia, associated with converging strabismus and deafness. Tumor removed. Partial relief. Strabismus and deafness not affected by the operation. During the second month following operation pain returned, when it was accidentally discovered that pressure on the left carotid stopped the pain. Vessel ligatured below the omo-hyoid. Operation in 1873. Patient reported in following year as being cured.

An analysis of cases operated upon by ligature of the common carotid, with special reference to duration of relief gives the following :

Number of cases in which duration of relief exceeded three years, four; number of cases in which relief lasted between one and three years, three; number of cases in which duration of relief was less than one year, four; number of cases in which only partial relief followed operation, one; number of cases in which no relief followed operation, two; number of cases in which death was attributed to operation, one; number of cases reported cured, but in which duration of relief could not be ascertained, two.

Longest period of relief, eleven years; shortest period of relief, two months.

Among the fatal cases I have not included that of von Nussbaum, for the reason that the death did not occur as a result of the operation, but from a recurrence of the hæmorrhage, for the arrest of which the operation was resorted to. It is

¹ L. C. Lane, *Trans. Med. Soc., California*; *Am. Journal Med. Science*, October, 1884; Wyeth, p. 62.

questionable whether the case should find a place at all in this list; but it is introduced for the purpose of calling attention to some of its very interesting features.

It should be remembered that many of these cases, reported as completely cured, may be still living and continue free from the malady.

Hueter¹ credits G. Fischer with having reported fifty-four cases, but upon investigation I find that the article there referred to is a report of fifty-four cases of ligature of the carotid for *nervous diseases*.² Thirty-four of these were cases selected from a collection of 600 cases of ligature of the vessel, by Pilz.³ Twenty-three of this series of thirty-four cases were done for epilepsy. Fischer, in a foot note, states that Pilz had privately shown him a list of 300 more cases of carotid ligation, and it is presumed that the balance of the fifty-four cases, twenty in number, were made up from this list. How many of this latter were for trifacial neuralgia it is impossible to say, as Fischer classes them all together as cases of tying the carotid for "nervous disorders." Of the thirty-four cases taken from the published list of Pilz, the following comprises those which can in any manner be said to relate to the subject under study and which are not included in the preceding:

LISTON. June 22, 1817. Female, æt. 24. "Headache." Persistent pain in left cheek and upper jaw, spreading over entire face. Compression of carotid gave some alleviation. Result: Operation gave no permanent relief. (*Edinburg Med. and Surg. Journal*, 1820, p. 66).

KRIMER. Male, æt. 48. "Headache." Result: Alleviation. Patient died thirteen months after the operation. Autopsy revealed an aneurism of the arch of the aorta and dilatation of the right auricle. Brain anæmic.

(Kleinert Report. 1830, Heft 9, s. 124, aus. *Hohnbaum und Jahn's Med. Conversationsblatt*, Jassgang 2, No. 16, s. 121-125).

PRESTON. 1831. Male, æt. 24. Partial paralysis and headache. Result: Temporary relief. The patient seems to have had some

¹*Grundriss der Chirurgie* 1880, Specieller Theil, p. 333.

²G. Fischer. *Krankheiten des Halses*, 1880. Lieferung 34, *Deutsche Chirurgie*, p. 59.

³Pilz. *Archiv. fur klinisch, Chirurgie*, IX, Berlin, 1868.

amelioration of the paralysis, as well. (*Trans. Calcutta*, vol. vi., p. 394).

PARSONS. 1846. Male, æt. 19. Headache, remittent in character, of two years' standing. Result: No permanent relief. Abatement for some weeks. Patient died in a few months; cause of death not stated. (*Am. Jour. Med. Science*, April, 1848, p. 360).

In a recent article upon ligature of the common carotid for trifacial neuralgia,¹ the writer refers to this collection of fifty-four cases by Fischer, quoted by Hueter, as if they were all for trifacial neuralgia. Another writer had previously fallen into the same error². Hueter says: "Occasionally attempts have been made to heal neuralgia of the trigeminus and similar nervous disorders by ligatures of the common carotid." Further on he states that "the above mentioned statistics contain fifty-four cases of this sort."

The mortality of the operation of ligature of the common carotid is much lower in this class of case as compared to that which follows ligature of the vessel for aneurism. According to Hueter who bases his estimate upon the cases reported by Fischer, a fatal result, due to the operation itself, occurred in 5 per cent of the whole number. Prof. J. A. Wyeth³, of New York, in a summary of 789 cases in which the common carotid was tied for all causes, states that 323, or 41 per cent, died. Although the operation, as applied to the relief of neuralgia is of comparatively recent introduction, and the number of cases reported thus far is relatively small, yet we would naturally expect much better results from its application to this class of cases, than in those in which it is resorted to for disease arising from degenerative changes in the vessel or its branches. The mortality although seemingly low, yet is not sufficiently so to warrant its performance in this class of cases until all other, and less grave measures, have been tried and found to be futile. Again, the prognosis regarding the disturbances of the cerebral functions are to be taken into account. Hemiplegia with or without aphasia, facial paralysis, paralysis of the opposite

¹*New York Med. Journal*, April 11, 1885.

²*Am. Journal Med. Sciences*, April, 1883.

³Essays in Surgical Anatomy and Surgery, New York, 1879.

arm, delirium, convulsions, and other minor disturbances, such as headache, occur in at least 7 per cent of cases operated upon for all causes¹. In all probability, as has been suggested by Wyeth, a much larger proportion of cases develop these symptoms than at first glance would appear. According to the tables of the latter, at least three-fourths of the cases in which symptoms of cerebral disturbances occurred, hemiplegia was the condition noted. In thirty-four autopsies upon patients who perished as a result of the operation, and in which the brain was examined, the points of interest in connection with this organ were as follows²:

Brain, softened in	-	-	-	-	-	-	-	16
Brain, inflamed	-	-	-	-	-	-	-	8
Brain, anæmia of	-	-	-	-	-	-	-	1
Brain, extravasation of blood	-	-	-	-	-	-	-	1
Brain, abscess of	-	-	-	-	-	-	-	7
Brain, abscess and softening	-	-	-	-	-	-	-	1
Total	-	-	-	-	-	-	-	34

Two hundred cases of death following ligature of the common carotid were studied with reference to interference with the functions of the brain, with the result of showing that twenty-seven per cent of these died from this cause.³ These facts are very suggestive and invite the surgeon's attention before resorting to this measure. In cases of neuralgia of peripheral origin, ligature of the external carotid might be first tried, for the reason that by this means the nutrition of the parts supplied by this vessel, particularly through its internal maxillary branch, could be modified. These parts are likewise identical with the general distribution of the second or superior maxillary division of the fifth nerve, this being more frequently the seat of intractable neuralgia than either of the other divisions. Ligature of the external carotid, if successful, would save the patients the risk of the development of brain symptoms; a diminished danger to life would likewise result from such a course, for it has been shown that the mortality following ligature of this vessel for all causes is only $4\frac{1}{2}$ per cent, as compared to 41 per cent in cases of ligature of the common

¹Wyeth, Op. cit.²Wyeth, Op. cit.³Wyeth, p. 118.

carotid generally.¹ This mortality of $4\frac{1}{2}$ per cent, in these days of antiseptic surgical practice, and applied to cases such as those under study, in which no disease of the vessel or its branches is present, would probably be still further lessened. Of three cases in which Roser tied the external carotid for facial neuralgia², one is reported as having been cured by the operation. With the slight risk involved in this latter operation, compared to ligature of the common carotid, and with the latter operation still in reserve in case of failure, in properly selected cases the less formidable procedure should certainly be executed first.

CONCLUSIONS.

In estimating the degree of success in these operations the facilities offered for a repetition of the same, in cases in which the pain returns, is a question worthy of serious consideration. For instance, in cases in which the operation of nerve-stretching has been performed for neuralgia of central origin, the destructive changes which the nerve undergoes, and upon which, conjoined with the counter-irritant effect of the traumatism itself, the improvement depends, occupy, according to the statement made by Hahn, a period of about eight months. In these cases of central origin it becomes a very serious question as to whether it were better to exsect the nerve, and thus cut off all means of giving relief in the future by destroying the only channel through which any effect can be produced upon the diseased central organ, or, on the other hand, by the very simple method mentioned, nerve-stretching, produce the changes which experience seems to indicate have a very decided tendency to bring about relief, temporarily at least, from the almost insupportable pain.

When the disease is of undoubted peripheral origin, this question need not arise. Here, the relief, theoretically speaking, should be decided and lasting following a neurectomy, and no choice will be left the surgeon, if he desires to give his patient the benefit of the very best means of obtaining permanent relief. But the differential diagnosis is not always easily

¹Wyeth, p. 134.

²Madelung, *Archiv. f. klinisch. Chirurg. Bd. 17.*

made, nor will the limits of this article permit a review of what knowledge the profession is in possession of that would assist in clearing up certain cases involved in what seems to be an almost impenetrable obscurity. Nor will preliminary operations of neurotomy or nerve-stretching serve to clear up the diagnosis, for the relief obtained, either in its completeness or duration, bears no relation to the gravity of the disease in the central organ if the disease be of central origin. No estimate can be placed upon the value of either procedure as a curative measure until sufficient time has elapsed to cover at least the average time for the processes of degeneration and regeneration to take place. As before stated, cases in which immediate union of a divided nerve takes place must be rare, and instance in which the pain recurs almost immediately are due to an anastomosis (using this expression in a restricted sense) of neighboring nerve filaments. Operative measures, it will be, therefore, at once seen, can be of but slight service in assisting to clear up the diagnosis between neuralgias of central and those of peripheral origin. The pain may recur at once from assumption of function by other nerves, in either variety of the disease: the process of degeneration, following an interference with the integrity of a nerve trunk may, for several months, hold the pain in abeyance: upon the completion of the regenerative process this may return, in either one or the other case,

Owing to the obscurity, therefore, in which the morbid process underlying many of these cases is involved, it will often be found difficult to decide upon the precise operative procedure indicated. The following conclusions, however, may be advanced as the result of the experience of surgeons up to the present day:

1. Neuralgias of the fifth cranial nerve, of peripheral origin, which have resisted methods of treatment other than operative, may be expected to yield to the operation of neurectomy of the trunk or trunks whose branches are distributed to the painful area. In this class of cases the neurectomy should be carried, if possible, to the point at which the nerve makes its exit from the cranium.

2. Cases of central origin should be first submitted to a

limited neurectomy, conjoined with nerve-stretching, in the hope that the process of degeneration thus set up, together with the rest gained by interrupting the centripetally conducted stimuli may favorably influence the diseased central organ. In case of relapse this may be repeated, providing the period of rest thereby gained corresponds to the length of time which Waller's investigations show to be usually occupied by the process of degeneration and regeneration. If no relief is gained, a similar operation should be performed upon all of the divisions of the fifth nerve. This failing, a complete neurectomy of each division accessible should be done; and finally, ligature of the common carotid may be tried as a last resort.

3. In cases of doubtful origin, a complete neurectomy followed, in cases which relapse by ligature of the external and common carotid, in turn, hold out the best prospect of cure.

4. A complete neurectomy of the second division of the fifth necessarily involves the extirpation or destruction of the sphenopalatine ganglion; and to this fact, rather than to any intrinsic tendency of the ganglion itself to keep up the irritation causing the neuralgia, is to be attributed, in all probability, any increasing immunity from relapse claimed to have been obtained in those cases in which Carnochan's operation has been performed.

5. No patient should be denied, other things being equal, the chance which any one, or all these operations in turn may give him of escaping, even for a short time the intolerable suffering incident to an intractable or otherwise irremediable facial neuralgia.

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